

REMARKS/ARGUMENTS

Claims 1-5, 7-9, and 11-36 are pending in the application, among which claims 26-31 have been withdrawn from consideration. Claims 1 and 36 are independent claims. Claims 6 and 10 have been previously cancelled without prejudice or disclaimer. New claims 33-36 have been added by this Amendment.

Allowable Subject Matter

Applicants thank the Examiner for the indication that claim 32 would be allowable if rewritten independent form including all of the limitations of the base claim and any intervening claims. Applicants believe that in light of the amendments and remarks made herewith, each of the claims pending in the present application is allowable. New claim 36 is claim 32 rewritten in independent form including all of the limitations of the base claim and any intervening claims and, therefore, is deemed to be allowable.

Claim Rejections under 35 USC § 103

Claims 1, 3, 4, 7, 8, 11, 15, 16, 19 and 21-25 stand rejected under 35 USC § 103(a) as unpatentable over U.S. Pat. No. 6,860,620 (“Kuan”). Claims 2, 9, 12-14, 17, 18 and 20 stand rejected under 35 USC § 103(a) as unpatentable over Kuan. Claim 5 stands rejected under 35 USC § 103(a) as unpatentable over Kuan in view of U.S. Pat. No. 7,273,987 (“Becker”).

Independent claim 1 recites “a flexible circuit board comprising electrical conductor tracks and a thermally conductive layer”, “wherein the thermally conductive layer and the electrical conductor tracks are positioned in a same plane of the flexible circuit board”, and “wherein the thermally conductive layer occupies at least 60 % of an area of said same plane.”

The Examiner acknowledges that Kuan fails to disclose that the thermally conductive layer occupies at least 60% of an area of said same plane. However, the Examiner simply reasons that a bigger area is better because a bigger area would provide better heat removal. More specifically, the Examiner states that it would have been obvious to a person of ordinary skill in the art at the time of the invention to provide the circuit board of Kuan with the thermally conductive layer occupying at least 60% of an area of the same plan in order to have a better heat removal rate. However, this statement by the Examiner simply ignores the fact that more material means higher manufacturing costs. A person skilled in the art at the time of the invention would design a heat removal area of a printed circuit board to be as large as necessary to remove the heat generated by the components to be mounted on the printed circuit board, and no more. See, for example, col. 3, lines 60-64, of Kuan, which clearly indicates that cost is a design factor. Thus, one skilled in the art would not simply make the heat sink as larger.

Furthermore, Kuan discloses an arrangement in which the heat sink tracks are rectilinear and are arranged between rectilinear electrical conductor tracks. Therefore, the arrangement of the heat sink tracks is limited to the space between the electrical tracks. The space between the electrical tracks in Kuan is not 60% of the plane of the circuit board on which the conductor tracks are arranged. MPEP 2144.05(II)(B) states that a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In fact, Kuan discloses at col. 3, lines 55-60, that within the context of the configuration of Kuan, the thickness of the layer affects the heat sink capabilities.

Further, MPEP 2143 states that "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." KSR, 550 U.S. at ___, 82 USPQ2d at 1396. Here the Examiner is combining the teaching of Kuan with the general statement that a bigger thermally conductive layer is better. Only the present invention presents a different configuration of the electrical conductor tracks and thermally conductive layer that allows the thermally conductive layer to occupy at least 60% of an area on the circuit board. The inventors made this configuration so that the circuit board could accommodate high power light emitting diodes while maintaining a relatively small circuit board. Based on the teachings of Kuan, there is no reason that one skilled in the art would have made an area of the heat sink layer to be at least 60% of the same layer in which the electrical conductors are arranged.

For all of the above reasons, the rejection of claim 1 in view of Kuan should be withdrawn.

Claims 2-5, 7-9, and 11-32 depend, directly or indirectly, from allowable independent claim 1.

The other cited reference, Becker, was cited by the Examiner as purportedly disclosing the features of dependent claim 5. However, nothing has been found in Becker that would remedy the deficiencies of Kuan with respect to the features of claim 1 discussed above.

In view of the above, withdrawal of the rejections under 35 USC § 103 is therefore requested.

New Claims 33-35

As shown in Applicants' Fig. 2, disclosed embodiments of the present invention include a thermally conductive layer 21 that is not in the shape of a "stripe" but, rather, has convexly and

concavely formed sections which partially surround at least one of the connection locations 13. Furthermore, the thermally conductive layer 21 for each section 11 may be assigned to a separate single light-emitting diode chip. In contrast, Kuan shows that the heatsink track 122 connects at least two light-emitting diodes with each other so that two light-emitting diodes are thermally connected to the same heatsink track 122. The heatsink track 122 thus connects the light-emitting diodes with the heatsink metal frame 108 and, according to the Examiner, dissipates heat from the light-emitting diode to the heatsink metal frame.

New dependent claim 33 recites “wherein the thermally conductive layer has at least one recess or concave region which partially surrounds at least one of the electrical conductor tracks.”

New dependent claim 34 recites “wherein the thermally conductive layer is free of a region which is in the form of a stripe or rectangle.”

Kuan discloses a light unit having light-emitting diodes wherein a layer 122 (which the Examiner asserts corresponds to Applicants’ claimed thermally conductive layer), has the shape of a “stripe”. More specifically, Kuan discloses an arrangement in which the heat sink tracks are rectilinear and are arranged between rectilinear electrical conductor tracks. Kuan therefore does not and cannot teach or suggest “wherein the thermally conductive layer has at least one recess or concave region which partially surrounds at least one of the electrical conductor tracks” and “wherein the thermally conductive layer is free of a region which is in the form of a stripe or rectangle”, as now expressly recited by new claims 33 and 34, respectively.

New dependent claim 35 recites “at least one additional thermally conductive layer separated from the thermally conductive layer, wherein each of the thermally conductive layer and the additional thermally conductive layer is connected to a different single light-emitting diode.”

As disclosed in paragraph 44 of the published version of the present application, the light emitting diode arrangement according to example embodiments can be separated, e.g., along the line CC' in Fig. 2, into at least two arrangements with an arbitrary number of diodes. In contrast, Kuan's frame 108 would be destroyed and rendered completely inoperable if such a separation were to be attempted. Kuan thus fails to teach or suggest "at least one additional thermally conductive layer separated from the thermally conductive layer, wherein each of the thermally conductive layer and the additional thermally conductive layer is connected to a different single light-emitting diode", as now expressly recited by new claim 35.

The other cited reference, Becker, was cited by the Examiner as purportedly disclosing the features of dependent claim 5. However, nothing has been found in Becker that would remedy the deficiencies of Kuan with respect to the features of new claims 33-35 discussed above.

New claims 33-35 are thus deemed to be patentable over the cited art for at least these reasons.

Conclusion

Based on all of the above, it is respectfully submitted that the present application is now in proper condition for allowance. Prompt and favorable action to this effect and early passing of this application to issue are respectfully solicited. Should the Examiner have any comments, questions, suggestions or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

Please charge our Patent and Trademark Office Deposit Account No. 503111 in the amount of \$180.00 payment of the fee for three (3) additional claims in excess of twenty.

It is believed that no additional fees or charges are required at this time in connection with the present application. However, if any fees or charges are required at this time, they may be charged to our Patent and Trademark Office Deposit Account No. 503111.

Respectfully submitted,
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